Improving Morocco’s olive industry, from harvest to waste disposal

Morocco’s 16,000 traditional maâsras are wasteful and unsanitary. (Photo courtesy of IAV)

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Michelle Hibler

It’s a scene that has changed little over the centuries in Morocco’s countryside. In the late January sunlight streaming through the open door of the small outbuilding, a patient, blindfolded horse slowly circles a concrete vat. He is the engine of this olive crusher, pulling the stone grinding wheel under which family members push the last of the season’s harvest. After two hours or so the mash will be packed into donut-shaped rope baskets called ‘sourdins’ and placed under a simple screw press. Stored in plastic containers, the oil will serve the family’s needs for the rest of the year.

This small artisanal oil press — a maâsra — on the side of the road to Khouribga in central Morocco is one of about 16,000 similar installations throughout the country. Together they process close to 60% of the olive oil produced in the country.

The process is laborious, explains Dr Mustapha Ismaili-Alaoui of the Institut Agricole et Vétérinaire Hassan II (IAV), in Rabat. [See related researcher profile: Morocco’s aromatic plants find a champion: Researcher Profile, Dr Mustapha Ismaili-Alaoui] It is also unscientific and unsanitary. Transported from the groves to the maâsra, the olives are simply sieved to remove

leaves. They are then piled on tarps or in boxes on the ground, sometimes for weeks. "This practice has to be stopped," says Dr Ismaili-Alaoui, because the olives soon start to ferment. To keep the entire crop from being spoiled, farmers mix coarse salt into the olives. And because the olives are not washed before crushing, that salt inevitably finds its way into the oil.

The maâsras are also wasteful. After pressing, the olive pomace — pulp and pits — still contains a lot of oil. Up to 900,000 litres of oil are wasted a year, says Dr Ismaili-Alaoui. What's more, the oil — "all of it," he says — is of poor quality. In fact, by international standards, it is unfit for human consumption because of its high acidity. But, he says, "Moroccans are used to this oil — they've even developed a taste for it."

Turning wastes into feeds

This may soon not be good enough. If today close to 500,000 hectares are devoted to growing olives in Morocco, the National Olive Production Plan seeks to double this area by 2010. The Plan also aims to improve the quality of the oil produced. Not only will this require better ways of handling the harvest, but also of handling the wastes. Today, 180,000 tonnes of pomace are left after processing. While some is dried and burned as fuel, much of it is simply dumped on vacant lands or alongside streams, polluting soils and water.

These are the problems Dr Mustapha Ismaili-Alaoui and his team at the IAV set out to solve in 1995, in collaboration with researchers at Agriculture and Agri-Food Canada's Food Research and Development Centre (FRDC) in Saint-Hyacinthe, Québec, and with support from the International Development Research Centre (IDRC).

A first step was to find an economic use for the pomace and for bagasse, the by-product of the sugar industry. By mixing these two wastes with local varieties of fungi and fermenting them, the researchers found they could improve the mixture's digestibility and increase its protein content. That made it suitable as an animal food, something much needed by Morocco's small farmers. A small, double-walled, plastic-sheet solar greenhouse, designed to facilitate the fermentation process, was field-tested in two regions of Morocco: Beni Mellal in the centre of the country and Errachidia in the arid South. [See related article: Using All of the Olive: Transforming an Environmental Problem into an Economic Opportunity] The fermenter can also be used as a dryer, says Dr Ismaili-Alaoui, so farmers can dry all sorts of plants, fruit, and vegetables.

The research team then set out to scale up and streamline the process, using ordinary farm equipment, as Dr Ismaili-Alaoui and his team demonstrate in the field behind the IAV.

While a technician shovels pomace into the small tractor-powered sheller, the pits are separated from the moist mash, which is then placed in an ordinary cement mixer. Water, molasses, and a powdered fungus "starter" are added. Poured into plastic-lined trays, the resulting slurry is placed on shelves in the fermenter. Within a day or two, explains Dr Ismaili-Alaoui, the protein content can be boosted to close to 20%. In 72 hours, the mixture is dry. This meal can replace up to half of commercial feeds in animal rations. "This simple technology can turn an environmental problem into a sustainable source of income and employment in rural areas," he says.

Value-added products

As the researchers worked on perfecting the animal feed, they noticed that the fungus used to ferment the mixture produced its own by-products — large quantities of enzymes (lipases and esterases) that break down the fat in the olive mixture. In fact, says Dr Ismaili-Alaoui, more enzymes were produced than by any other process. These enzymes can catalyze many reactions to produce a broad range of compounds for the cosmetic, food, and pharmaceutical industries. One of the most interesting — and potentially marketable — are natural aromas. Again in collaboration with FRDC, the IAV team worked to refine the process. They have now succeeded in synthesizing a number of natural aromas, including apple, banana, and pineapple. Patents are being applied for and a unit is being set up at the IAV where the techniques and products will be demonstrated to various companies, explains Dr Ismaili-Alaoui.

With the increasing popularity of natural products over their chemical counterparts, the market for these aromas is potentially large, says Dr Ismaili-Alaoui. Even Morocco imports all its enzymes and aromas. Natural aromas of this type sell for anywhere between CAN$10 and $340 a kilogram on the world market. The fungus spores also have potential as organic pesticides against various plant pests and diseases.

Going back to the beginning

Dr Ismaili-Alaoui and his team then turned their attention back up the chain to what happened to olives before pressing because, he says, the quality of the oil depends on the quality of the olives themselves. They found many areas that could be improved. For instance, he says, farmers typically hit tree branches with a stick to shake down the fruit. This damages the tree and reduces the next year's harvest. Nor are the olives harvested at the optimal moment: until recently a national harvest date was fixed in December by the Ministry and was immutable, regardless of the region or whether the olives had ripened early or were still not yet ready. That has now changed, in large part due to the IAV team's research. Ideally, he says, you need a mix of green, semi-ripe, and ripe olives to produce the best oil. Too green, and you obtain less oil, which oxydizes quickly because the chlorophyl content is too high. Too ripe, and the olives are past their prime.

Producing higher quality oil also requires improving the techniques used in the maâsras. When the olives are harvested, he explains, they have to be sieved to remove leaves, then washed, then pressed. This has to be a continuous process, without periods of storage or interruptions.

That's what the team's new invention does. During the 2002-2003 harvest, the researchers demonstrated their new turnkey, mechanized maâsra. The petrol- or electricity-powered "all-in-one" unit can be moved by tractor from farm to farm, avoiding the need to transport and store olives. In one continuous operation the mobile maâsra washes, grinds, and presses the olives — up to four tonnes a day, a significant increase over the 260 kg the average maâsra can handle. And, says Dr Ismaili-Alaoui, all parts of the machine in contact with the olives and the oil are stainless steel.

The mobile maâsra would go a long way to helping meet the government's plans to modernize smallholders' olive oil presses. The prototype is now being put through its paces by oil producers in the Tafilalet region in Morocco's arid south. But it has already drawn favourable reviews: late in 2002, it won first prize for technical innovation at an agricultural fair in Errachidia.

Michelle Hibler is Chief, Writing and Translation, in IDRC's Communications Division.

For more information:

Dr Mustapha Ismaili-Alaoui, Institut agronomique et vétérinaire Hassan II, BP 6202, Rabat-Instituts, Rabat, Morocco; Phone: 212.37.77.23.01; Email: m.ismaili@iav.ac.ma